THE OPEN UNIVERSITY OF SRI LANKA

CONTINUOUS ASSESSMENT TEST I - 2013/2014

MPZ 3132 – ENGINEERING MATHEMATICS IB

DURARTION: ONE AND QUARTER $\left(1\frac{1}{4}\right)$ HOURS

Registration No: ……

Date: **26th January 2013** Time: 1545hrs – 1700hrs

Instructions:

- **Answer all the Questions**
- **Number of pages in the paper – 05.**
- **All symbols are in standard notation.**

Important integrals

- $\int e^{ax}\sin bx\,dx = \frac{e^{ax}}{a^2+b^2}(a\sin bx - b\cos bx)$
- $\int e^{ax}\cos bx\,dx = \frac{e^{ax}}{a^2+b^2}(a\cos bx + b\sin bx)$
- $\int f(x)e^{ax}\,dx = \frac{1}{a}f(x)e^{ax} - \frac{1}{a^2}f^1(x)e^{ax} + \frac{1}{a^3}f^2(x)e^{ax} \ldots\ldots\ldots\ldots\ldots\ldots\ldots$

  Sign alternate $(+-+-+-+-+\ldots\ldots\ldots)$
- $\int f(x)\cos ax\,dx = \frac{1}{a}f(x)\sin ax + \frac{1}{a^2}f^1(x)\cos ax - \frac{1}{a^3}f^2(x)\sin ax - \ldots\ldots\ldots\ldots\ldots$

  Sign alternate in pairs $(++--++--++--++--++--\ldots\ldots\ldots)$
- $\int f(x)\sin ax\,dx = -\frac{1}{a}f(x)\cos ax + \frac{1}{a^2}f^1(x)\sin ax + \frac{1}{a^3}f^2(x)\cos ax - \ldots\ldots\ldots\ldots\ldots$

  Sign alternate in pairs after the first term $(++--++--++--\ldots\ldots\ldots)$
- $\int \sec ax\,dx = \frac{1}{a}\ln|\sec ax + \tan ax|$

01. I) Define a Fourier series and write down the formulae for the coefficients of Fourier series.

II) Given that $f(x) = x + x^2$ for $-\pi \le x \le \pi$, find the Fourier expression of *f(x)*.

Deduce that $\frac{\pi^2}{6} = \sum_{n=1}^{n} \frac{1}{n^2}$.

02. I) Find the Fourier series expansion of the periodic function of period 2π,

$f(x) = x^2, \quad -\pi \le x \le \pi.$

II) Hence, find the sum of series $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots$

03. I) Define the Taylor polynomial of a function *f(x)* about $x=a$.

II) If $f(x) = \ln(1 - x + x^2)$ prove that $(1 - x + x^2)\frac{d^2 f(x)}{dx^2} + (2x - 1)\frac{df(x)}{dx} - 2 = 0$.

III) Find the 7^{th} Taylor polynomial of $f(x)$ about $x=0$.